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Abstract

Design of Wireless and Traceable Sensors for Internally Illuminated Photoreactors †

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Abstract: We have presented methods for the wireless powering of photobioreactors and photocatalytic reactors before. Wireless powering for the internal illumination of those reactors is necessary due to the limited penetration depth of photons in those media. In order to control the processes in those reactors, several sensors are necessary. In the case of photobioreactors for the cultivation of photosynthetic active microorganisms or cells, the quantities to be measured are e.g., oxygen and carbondioxide concentration, illumination, optical density and temperature. In the case of photocatalytic reactors this can also be chemical concentrations. Classically, the sensors are installed in the reactors through a drill hole. This clearly has the drawback that the desired quantity can only be measured at one point inside the reactor and the spatial distribution is unknown. Here, we present methods to develop wireless sensor systems to overcome these problems. The floating sensors are wirelessly powered by the magnetic field mentioned above. The sensor signals are transmitted via on-off modulation among other methods which are being tested. The modulation frequency is located a factor of 1.3 above the excitation frequency in order to avoid interference by harmonics. Additionally, standard frequencies like 433 MHz are under consideration, as used by similar projects. The drawback of those high frequency standard protocols is the high damping factor in electrically conducting media. The traceability of our floating sensors is another important aspect. This goal is reached by evaluating the received sensor signal amplitude with an array of receiving coils.

Keywords: wireless sensors; photoreactor; internal illumination; wireless power